

What is claimed is:

1. A panel processing apparatus for applying a product to a portion of at least one panel, comprising:
 - 5 a housing having a first side and a second side, wherein said second side is adapted to communicate with said panel, said first and second sides defining an interior space, and
an entry port formed in said first side of said housing and adapted to be fluidly coupled to a fluid delivery system,
 - 10 wherein said second side of said housing is adapted to provide at least one of a fluid and a gas from the entry port through said interior space to the through hole in the panel.
2. A panel processing apparatus according to claim 1, further comprising:
 - 15 a frame oriented opposite to said second side for supporting the panel,
wherein said second side of said housing and said frame are adapted to hold therebetween the one or more panels.
3. A panel processing apparatus according to claim 2, further comprising a location
20 adjustment apparatus to vary a distance between said frame and said housing.
4. A panel processing apparatus according to claim 2, further comprising
a first pressure pin coupled to said housing and having a distal end extendable to intersect a plane formed by said second side of said housing,

wherein said second side of said housing and said frame are adapted to hold therebetween a plurality of panels, each panel having at least one through hole disposed in fluid communication with at least one through hole of the other panels of said plurality of panels, and

5 wherein said first pressure pin is adapted to apply pressure to the panels to reduce a space between the panels to generally retain the metalization product to the through holes when passing therethrough.

10 5. A panel processing apparatus according to claim 4, further comprising a first roller mounted to said distal end of said first pressure pin, wherein said first pressure pin is slidably coupled to said housing to allow said roller to travel parallel to or within said plane formed by said second side.

15 6. A panel processing apparatus according to claim 4, further comprising a second pressure pin coupled to said frame and having a distal end extendable to intersect a plane formed by one side of said frame.

20 7. A panel processing apparatus according to claim 6, further comprising a second roller mounted to said distal end of said second pressure pin, wherein said pressure pin is slidably coupled to said frame to allow said roller to travel parallel to or within said plane formed by said second open side.

8. A panel processing apparatus according to claim 7, wherein said first pressure pin and said second pressure pin are oriented along a single line.

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9. A panel processing apparatus according to claim 4, wherein said frame comprises a second housing having a side facing the panels.

10. A panel processing apparatus according to claim 4, wherein said second side of
5 said housing and said frame are adapted to hold therebetween at least ten panels, each panel having at least one through hole in fluid communication with at least one through hole of the other panels of said plurality of panels.

11. A panel processing apparatus according to claim 2, wherein either said frame or
10 said housing employs a pressure pin.

12. A panel processing apparatus according to claim 2, wherein said housing and said frame are plenums.

13. A panel processing apparatus according to claim 2, further comprising
15 a fluid drain coupled to an egress port of said frame and adapted to drain said fluid.

14. A panel processing apparatus according to claim 2
20 wherein said second side of said housing and said frame are substantially parallel to each other.

15. A panel processing apparatus according to claim 14, further comprising

a first pattern plate, located along and sized to cover said second side and formed with at least one through hole configured to correspond at least partly with at least one through hole of the one or more panels.

- 5 16. A panel processing apparatus according to claim 2, further comprising
an intermediate housing located between said housing and said frame and having
third and fourth sides in fluid communication with each other,

wherein said third open side is oriented substantially parallel and opposite to said
second side and adapted to communicate with the panel located between said housing
10 and said intermediate housing, and

wherein said fourth open side is oriented substantially parallel and opposite to
said second open side and adapted to communicate with another panel located between
said intermediate housing and said frame.

- 15 17. A panel processing apparatus according to claim 16, further comprising
third and fourth seals each mounted to said intermediate housing along
circumferences of said third and fourth open sides, respectively, and adapted to sealingly
contact said panel and said other panel, respectively.

- 20 18. A panel processing apparatus according to claim 17, further comprising
a fourth pattern plate, located along and sized to cover said fourth open side and
formed with at least one through hole configured to correspond with at least one through
hole of said other panel.

- 25 19. A panel processing apparatus according to claim 17, further comprising

a third pattern plate, located along and sized to cover said third open side and formed with at least one through hole configured to correspond with at least one through hole of the panel.

- 5 20. A panel processing apparatus according to claim 2, further comprising
a seal mounted to said housing along a circumference of said second side,
adapted to sealingly contact the panel,

a first pressure pin coupled to said housing and having a distal end extendable to intersect a plane formed by said second side of said housing,

- 10 a second pressure pin coupled to said frame and having a distal end extendable to intersect a plane formed by one side of said frame.

wherein said second side of said housing and said frame are adapted to hold a plurality of panels, each panel having at least one through hole disposed in fluid communication with at least one through hole of the other panels,

- 15 wherein said first pressure pin is adapted to apply pressure to the panels to reduce a space between the panels to generally retain the metalization product to the through holes when passing therethrough, and

wherein said frame comprises a second housing having a side facing the panels.

- wherein said second side of said housing and said frame are adapted to hold
20 therebetween at least ten panels, each panel having at least one through hole in fluid communication with at least one through hole of the other panels.

21. A panel processing apparatus according to claim 20, further comprising

a first pattern plate, located along and sized to cover said second side and formed with at least one through hole configured to correspond with at least one through hole of the plurality of panels.

5 22. A panel processing apparatus according to claim 2, wherein said product is a selected metalization product.

23. A panel processing apparatus according to claim 2, wherein said product is adapted for electroless copper deposition.

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24. A panel processing apparatus according to claim 2, wherein said product is adapted for electroplating of copper for a printed circuit board.

25. A panel processing apparatus according to claim 2, wherein said product is
15 adapted for at least one of chemical etchback and desmear.

26. A panel processing apparatus according to claim 2, wherein said product is a slurry of pumice adapted for honing of a wall of the through hole.

20 27. A panel processing apparatus according to claim 2, wherein said product is adapted for chemical microetching of a through hole wall.

28. A panel processing apparatus according to claim 2, wherein said product is at least one of pressurized water and air for through hole blasting.

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29. A panel processing apparatus according to claim 1, wherein said panel is a circuit panel.

30. A panel processing apparatus according to claim 1, further comprising

5 a pattern plate, mounted to and sized to cover said second side of said housing, and formed with at least one through hole configured to correspond at least partly with at least one through hole of the panel.

31. A panel processing apparatus according to claim 1, further comprising

10 at least one alignment rod placed within an alignment hole of each panel to maintain alignment of said panels.

32. A panel processing apparatus according to claim 1, further comprising

15 a fluid delivery system fluidly connected to said interior space of said housing.

33. A panel processing apparatus according to claim 1, further comprising

a seal mounted to said housing along a circumference of said second side adapted to sealingly contact the panel.

20 34. An electroplating apparatus, comprising:

a first housing having a first side and an interior adapted to fluidly couple to a fluid delivery system,

a frame oriented opposite to said first side of said first housing,

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40. A method for applying a product to a plurality of panels, comprising the steps of:
stacking a plurality of circuit panels together,
aligning one or more through holes formed in each panel such that the through
holes are in fluid communication with each other to receive the product, and
5 introducing the product to the through holes of the stacked panels.
41. A method for applying a product of claim 40, further comprising the steps of
introducing a cleaner to travel through said through holes of the stacked panels,
introducing a rinse fluid to travel through said through holes of the stacked
10 panels, and
introducing a metalization product to travel through said through holes of the
stacked panels.
42. A method for applying a product to a plurality of panels of claim 41, further
15 comprising the step of introducing air to travel through said through holes of the stacked
panels.
43. A method for applying a product to a plurality of panels of claim 40, after the
step of aligning, further comprising the steps of providing a frame to mate with a side of
20 said stacked panels to receive said product after traveling through said through holes of
the stacked panels.
44. A method applying a product to a plurality of panels of claim 43, after the step of
providing a frame, further comprising the steps of providing a negative pressure

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wherein said first side and said frame are adapted to hold at least one panel having at least one through hole and provide fluid from said fluid delivery system through said first housing to pass through said at least one through hole,

an electrical connector electrically connected to said at least one panel, and

5 an anode electrically connected to an electrolytic fluid provided by said fluid delivery system and adapted to be electrically connected to said electrical connector to facilitate electroplating of a side of said through hole of said panel.

35. An electroplating apparatus according to claim 34, wherein said frame is
10 selectively moveably coupled to said first housing to vary a distance between said first housing and said frame.

36. An electroplating apparatus according to claim 34, wherein said frame comprises
a second housing having a side facing the panels.

15 37. An electroplating apparatus according to claim 34, wherein said electrical connector is a pin mounted within a locating hole within said at least one panel to fix the location of said panel.

20 38. An electroplating apparatus according to claim 34, wherein said electrical connector is a conductive brush contacting a side of said at least one panel.

39. An electroplating apparatus according to claim 34, wherein said electrical connector is conductive rubber contacting a side of said at least one panel.

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differential in said frame to enhance flow of said product through said through holes during said introducing step.

45. A method applying a product to a plurality of panels of claim 40, wherein said
5 step of introducing comprises the step of pressurizing said product.

46. A method applying a product to a plurality of panels of claim 40, wherein said product is a selected metalization product.

10 47. A method applying a product to a plurality of panels of claim 40, wherein said product is adapted for electroless copper deposition.

48. A method applying a product to a plurality of panels of claim 40, wherein said product is adapted for electroplating of copper for a printed circuit board.

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49. A method applying a product to a plurality of panels of claim 40, wherein said product is adapted for at least one of chemical etchback and desmear.

50. A method applying a product to a plurality of panels of claim 40, wherein said
20 product is a slurry of pumice adapted for honing of a wall of the through hole.

51. A method applying a product to a plurality of panels of claim 40, wherein said product is adapted for chemical microetching of a through hole wall.

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52. A method applying a product to a plurality of panels of claim 40, wherein said product is at least one of pressurized water and air for through hole blasting.

53. A method for applying a metalization product to a panel, comprising the steps of:

5 providing a housing to sealingly mate with a side of said panel having at least one through hole,

introducing said metalization product into said housing to travel through said through hole, and

removing said housing from said side of said panel.

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54. A method for metal processing of a panel according to claim 53, wherein said step of introducing a metalization product comprises the step of pressurizing said metalization product.

15 55. A method for metal processing of a panel according to claim 53, wherein the step of introducing a metalization product further comprises the step of introducing a cleaner into said housing to travel through said through hole.

20 56. A method for metal processing of a panel according to claim 55, wherein after the step of introducing a cleaner, the step of introducing a metalization product further comprises the step of introducing a rinse fluid into said housing to travel through said through hole.

25 57. A method for metal processing of a panel according to claim 56, wherein after the step of introducing a rinse fluid, the step of introducing a metalization product

further comprises the step of introducing a direct metalization fluid into said housing to travel through said through hole.

58. A method for metal processing of a panel according to claim 57, wherein after
5 the step of introducing a direct metalization fluid, the step of introducing a metalization product further comprises the step of introducing air into said housing to travel through said through hole.

59. A method for metal processing of a panel according to claim 53, after the step of
10 introducing, further comprising the steps of providing a second housing to sealingly mate with an opposite side of said panel having said at least one through hole.

60. A method for metal processing of a panel according to claim 59, after the step of
providing a second housing, further comprising the steps of providing a negative
15 pressure differential in said second housing to enhance flow during through said at least one through hole during said introducing steps.

61. A method for metal processing of a panel according to claim 53,
wherein at least one additional panel is stacked with said panel, such that said
20 additional panel has at least one through hole corresponding to said at least one through hole of said panel.

62. A method for electroplating a panel, comprising the steps of:
providing a housing to sealingly mate with a side of said panel having a direct
25 metalization deposit in at least one through hole,

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providing an electrical connector to electrically connect to said panel,
providing an electrolyte within said housing to travel out of said housing via said
at least one through hole,

providing an anode to electrically connect to said electrolytic fluid,
5 providing an electrical circuit including said electrical connector and said anode
while said electrolyte travels through said at least one through hole,
removing said housing from said side of said panel.

63. A method for electroplating a plurality of panels, comprising the steps of:
10 stacking a plurality of circuit panels together,
aligning one or more through holes formed in each panel such that the through
holes are in fluid communication with each other to receive a metalization product,
introducing the metalization product to the through holes of the stacked panels,
providing an electrical connector to electrically connect to said panel,
15 providing an anode to electrically connect to an electrolytic fluid,
introducing the electrolytic fluid to the through holes of the stacked panels, and
providing an electrical circuit including said electrical connector and said anode
while said electrolytic fluid travels through the through holes.

20 64. A method for electroplating a plurality of panels according to claim 63,
wherein before said step of providing a metalization product, further comprising
the steps of,
introducing a cleaner into said housing to travel through said through holes, and
introducing a rinse fluid into said housing to travel through said through holes.

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65. A method for electroplating a plurality of panels according to claim 63,
after said step of providing an electrical circuit, further comprising the steps of,
introducing air into said housing to travel through said through holes.

5 66. A direct metalization and electroplating apparatus for rendering a portion of one
or more panels conductive, said apparatus comprising:

a housing having a first side adapted to be fluidly coupled to a fluid delivery
system and a second side adapted to communicate with the panel, said first and second
sides defining an interior space for delivering a metalization product from the fluid

10 delivery system to one or more through holes formed in the panel,

a frame oriented opposite to said second side for supporting the panel, wherein
said second side of said housing and said frame are adapted to hold therebetween the
one or more panels and to provide fluid from the fluid delivery system through said
housing to the through hole in the panel,

15 an electrical connector electrically connected to said at least one panel, and

an anode electrically connected to an electrolytic fluid provided by said fluid
delivery system and adapted to be electrically connected to said electrical connector to
facilitate electroplating of a side of said through hole of said panel.